10-19-2004

Big Task, Small Subject: Wright Brothers Institute Endowed Chair Guides Nano Research

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Oct. 19, 2004
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NEWS RELEASE

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WRIGHT BROTHERS INSTITUTE ENDOWED CHAIR GUIDES NANO RESEARCH

DAYTON, Ohio — He may have 20/20 vision, but Liming Dai saw the need for extended-wear contact lenses that were both comfortable and breathable.

He used his skill in polymer manipulation and background in nanotechnology to help create the Focus Night & Day contact lenses that can be worn around the clock for 30 days.

He's at the top of his field, a fact that may be hard to wrest from this modest, polite and soft-spoken man. Yet his research prowess and accolades shouted volumes, and the University of Dayton listened and hired him as the Wright Brothers Institute Endowed Chair in Nanomaterials.

Dai is responsible for establishing a new nanomaterials lab and guiding research at UD in connection with the materials and manufacturing directorate of the Air Force Research Laboratory at Wright-Patterson Air Force Base. His position is the culmination of years of collaboration among groups looking to boost Ohio's technology-based economic development. The Dayton Development Coalition raised half the $3 million endowment for the position with support from Ohio and the business community, and the University of Dayton provided matching funds.

"What makes this position different than that of any other faculty chair in the nation is the central role it plays in the powerful collaboration between a federal laboratory, Ohio's Third Frontier program and the University of Dayton — which enjoys a well-established synergy in engineering, science and research," said Mickey McCabe, director of the University of Dayton Research Institute (UDRI).

Nanotechnology — what researchers describe as the science of constructing new materials with dimensions about the size of five to 10 atoms — has enormous potential. The U.S. government has authorized more than $2 billion since 2000 for nanotechnology research — with applications ranging from better computer chips to lighter aircraft that require less fuel. The technology could lead to tiny, fast transistors and the strongest, lightest materials ever made. UDRI, which performs $65 million of sponsored research annually, ranks first in Ohio and second in the nation in materials research funded by the federal government.

In Dai's new role, he plans to conduct research on biosensors and light-emitting polymers.

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He also sees promise in creating polymer photovoltaic cells.

"The development of nanoscale sensors could revolutionize the way in which many chemical and biomedical tests are performed in both research and clinical diagnostic laboratories," he said. "The recent development of polymer nanotechnology and intensive ongoing research into polymeric photovoltaic cells could provide the world with very cost-efficient and clean energy from sunlight, which will change our daily lives forever. Imagine if you had a car that ran on a photovoltaic cell during the day and stored energy for night. Imagine if you had a house equipped with such energy systems. You would never have bills for electricity and gas."

Dai talks about polymers with a passion that comes from having successfully arranged macromolecules and carbon nanotubes — tubes about one millionth of a millimeter in diameter — into graceful, geometric designs that best serve particular functions.

Take, for example, the contact lenses. Researchers in Australia were working with a silicon-containing polymer to make the contacts flexible. But, they found silicon to be abrasive to the eye surface. To solve this problem, Dai used a plasma technique to create a more comfortable nanofilm on the contacts.

In Australia, Dai also worked to create thin, flexible display screens. He and his colleagues created graceful star-shaped and hexagonal nanotube patterns. When electrons enacted from the nanotubes excite phosphorous molecules on the screen, light is displayed. Since the nanotubes are so small, the focus of each dot of light can be very specific. This, he said, creates a screen with vastly greater picture definition using much less energy. He added that he expects such screens, especially those for small-screen display, to come on the market within several years.

Dai is a full professor in the School of Engineering, with a joint appointment at UDRI. Later this year, a joint appointment will also be sought in the College of Arts and Sciences. His job includes looking at nanotechnology curriculum development for engineering and science graduate students, eventually folding undergraduates into the process.

Dai's road to UD started in his native China, where he received his bachelor's in chemical engineering and began his interest in polymers. He then traveled to Australia, where he received a Ph.D. in chemistry from the Australian National University, and completed post-doctoral work in Cavendish Laboratory at Cambridge University, England. Most recently, he taught at the University of Akron's College of Polymer Science and Polymer Engineering.

When he started at UD this fall, Dai had three offices — in Kettering Laboratories, in the Science Center near the nanomaterials lab and at Wright-Patterson Air Force Base — and two homes. Dai moved to Dayton, but his wife, Lin Zhu, and children, Kevin, 14, and Alvin, 8, will stay in the Akron area to finish out this academic year. Zhu is a physician working toward her certification to practice in the United States.

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For interviews, contact **Liming Dai** at (937) 229-2670 and **Mickey McCabe** at (937) 229-2113. For a photo, contact **Teri Rizvi** at (937) 229-3241 or rizvi@udayton.edu.